

## Article

# Green Insurance: A Roadmap for Executive Management

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**Abstract:** Anthropogenic climate change is accelerating, and severe and widespread consequences are expected in many areas. Although the insurance sector is not closely associated with any of the sustainability dimensions, expectations may change rapidly. Against this background, we analyze the role of insurers, especially in the property and casualty areas, in addressing the environmental and climate risk challenges and developing a truly sustainable, environmentally friendly business model—green insurance. Building on the Principles of Sustainable Insurance set by the United Nations, we develop a comprehensive roadmap along the insurance value chain for executive management to design their company’s sustainability efforts, with special focus on property and casualty. The roadmap indicates actions to be taken as well as metrics to be managed in product development, marketing and sales, risk management and underwriting and operations and claims management towards green insurance. The existing products, risk appetite and operational processes must be reviewed to support sustainability goals and include the full portfolio of activities, including claims. The time to act is now, the sustainability journey is complex and the proposed business model transformation should provide benefits for early movers.

**Keywords:** green insurance; sustainability; insurance management; value chain



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## 1. Introduction

The latest report of the Intergovernmental Panel on Climate Change (IPCC 2021) provides harsh evidence that anthropogenic, i.e., human-made, climate change is accelerating. There is little time left to limit the average temperature increase to below 2 °C as agreed in the Paris Accord. Increases above that level are modeled to have severe and widespread consequences. Against this background, the question of the role of the insurance industry in addressing the challenge arises. Correspondence analysis (GIM Foresight 2020) shows that customers closely associate companies in the automotive, aviation or utilities sector with specific climate concerns. The same is true for the fashion industry when it comes to social issues. The financial services and banking industry, on the other hand, and with it the insurance sector, is perceived to be farther away from any of the sustainability dimensions defined by the United Nations Sustainable Development Goals (United Nations 2015). While pressure from customers is limited for now, it may rise quickly in the future, not least because of increasing insurability and affordability issues (CRO Forum 2019). Expectations from regulators are also increasing quickly (cf. AM Best 2020; EIOPA 2019, 2021; FINMA 2019). Further pressure comes, for example, from the World Wildlife Fund, who initiated the Sustainable Financial Regulations and Central Bank Activities Tracker to assess and compare measures put in place by central banks, financial regulators and supervisors to foster a sustainable financial system in key countries worldwide (WWF 2022). Given the ubiquitous nature of the sustainability challenge and given that there is still significant discord as to

what is really sustainable at the level of specific measures, many insurance companies are overwhelmed by this topic. By illustration, as of August 2021, more than 100 companies worldwide have committed to abide by the Principles for Sustainable Insurance, including the three largest insurers (UNEPFI 2022b). However, only 21 of the top 100 companies are signatories to these principles and the rate of participation is considerably lower for smaller companies (SWFI 2022; UNEPFI 2022b).

Instead of defining sustainability, the Principles of Sustainable Insurance (PSI) indicate what sustainable insurance ought to be: “Sustainable insurance is a strategic approach whereby all the activities in the insurance value chain, including interaction with the public, are conducted in a responsible and prudent manner, involving the identification, assessment, management and monitoring of the risks and opportunities in relation to environmental, social and governance (ESG) issues” (UNEPFI and PSI 2020). Building on this definition and mindset, our paper aims at providing executive management, especially of small- and medium-sized insurance companies, a comprehensive roadmap to the topics they need to consider in designing the transition of their companies in response to the environmental and climate risk issues, i.e., the transition towards what we call green insurance.

A roadmap may prove particularly useful to facilitate the start of the transition, as standards for measuring, setting targets and reporting various aspects of sustainability have emerged, indeed mushroomed, potentially causing confusion. Those standards are often defined by international (United Nations) or non-profit organizations and refer to scientific work such as by the IPCC, and other mostly natural science-based work. However, academic literature on how to apply these standards in practice in everyday insurance operations is scarce. Scordis et al. (2014) are among the first to put the PSI in relation to the (general) literature on sustainability and value maximization. More recently, Gatzert et al. (2020) provided an overview of relevant sustainability risks and opportunities in the insurance industry. They addressed both the assets and liabilities, and took a broad corporate perspective. Khovrak (2020) discussed the ability of insurance companies to use an ESG-driven approach to managing their sustainable development, and Chiaramonte et al. (2020) studied sustainability practices and the stability in the insurance industry. Finally, Nobanee et al. (2021) carried out a bibliographic analysis of sustainability in life insurance.

Building on Pugnetti et al. (2022), our paper brings together the experience of insurance practitioners and provides a systematic approach to advance the sustainability of the insurance business model. By way of preview, we find that (i) the time to act is now. Insurers need to act for three reasons: (1) as good citizens given the magnitude of the impact of climate change on the economy and society, (2) given the insurance industry’s significant role in mitigating impact and fostering transition and (3) also due to their manifold exposure to climate change risks. We suggest it wise for insurers to (ii) prepare for this transition now, despite its many uncertainties and the long time horizons involved, before landing at the center of public, regulatory and investors’ attention to avoid being taken by surprise when that attention inexorably shifts. Finally, (iii) we posit that the business model transformation made necessary by (i) and (ii) also provides significant benefits for early movers to harvest the opportunities associated with a riskier world in transition. More specifically, the roadmap we provide indicates the set of actions to be taken as well as exemplary metrics to be managed in the areas of product development, marketing and sales, of risk management and underwriting and of operations and claims management. We find that executive management needs to review the existing leadership, risk analysis, monitoring and reporting. Further, insurance cover and services must include environmentally friendly features that support sustainable transitions. Finally, operational processes and in particular claims management must be challenged against the metrics of greenhouse gas emissions and set targets based on the full set of activities. A forceful sustainability program will require a clear set of metrics to understand the current positioning and to direct actions towards progress. We provide first guidance in regards to metrics that support the insurers’ transition from sustainability goals to actions—well aware of the difficulty of

setting targets and measuring progress given uncertain and complex interdependencies and long time horizons.

The remainder of this paper is organized as follows: In Section 2 we underline the relevance of the sustainability theme and propose the methodology and structure of the layout for this study. In Section 3 we review executive management actions along the insurance value chain, specifically focusing on product development, marketing and sales (Section 3.1), risk management and underwriting (Section 3.2) and operations and claims management (Section 3.3). In Section 4 we discuss the findings and propose an overall roadmap for action. We conclude the paper in Section 5.

## 2. Relevance and Methodology

Insurance assets constitute a significant wealth reserve. In Europe, they are equivalent to 13.2% of total household wealth (Credit Suisse 2017; IAIS 2019), while the assets of the largest 100 insurers are equivalent to 7.2% of household wealth worldwide (Credit Suisse 2017; SWFI 2022). Although insurers are not seen as direct polluters, the role of the financial services sector in funding activities either damaging to the environment or supportive of the transition to a sustainable economy has risen considerably in the last years. It is therefore no surprise that the question of how to manage investments in an ESG compatible way has become a top management concern. Meanwhile, a veritable industry around “green” investments has developed to address the issues. While still disputed and sometimes accused of greenwashing, the standards and offers now available provide top management in the financial services sector ample support in managing the active side of the balance sheet.

The passive side, however, has been much less in the focus. Nevertheless, pressure from investors and employees on insurers to address this side of the balance sheet as well is increasing. The increased attention is well founded, as the insurance industry represents a large component of the global economy. Insurance premiums account directly for 6.13% of the world’s GDP, varying between just below 3% in Africa and almost 6.5% in Europe (Swiss Re Institute 2018). Taking into account the multiplier effect of claims payments into a multi-sector economy (Bouakez et al. 2022), the indirect impact of insurance can extend to some 10% of the world’s GDP. In summary, the insurance industry is too significant a player to wait on the sidelines and must actively embark on a sustainability journey encompassing all aspects of its business.

This paper lays out a road map for executive management, specifically designed for smaller insurance companies, to help them organize the journey towards a greener future. We do this by summarizing the current status of debates along the classical value chain (Eling and Lehmann 2018; Porter 1985) of an insurance company, excluding, as explained above, investment management, which is well researched already. The objective is to provide a comprehensive overview of the topics to be addressed, even if the way to address them may not be entirely clear at this point.

The idea of the value chain as described by Porter (1985) is a systemic view on an organization, with every process step defining a subsystem consisting of inputs, internal activities and outputs that form the inputs of the next subsystem in the process chain or to the outside world. The concept is well suited for our topic for two reasons: First, it ensures a generic view of all activities a company performs irrespective of the specific organizational structure of the individual company, and, second, it forces us to consider the interconnected and all-encompassing nature of the sustainability topic in a systemic manner. For similar reasons, Eling and Lehmann (2018) applied the value chain concept to the ongoing digital transformation, which is comparably all-encompassing in its nature as the sustainability transformation ahead. Furthermore, the current state of literature on green insurance does not provide comparative approaches yet. In the following (see Section 3), we consider the three main parts of the value chain, namely, (1) product development, marketing and sales, (2) risk management and underwriting, (3) operations and claims management.

### 3. A Roadmap along the Insurance Value Chain

We are aware that virtually all parts of an insurance company have a role to play in the sustainability transformation, including but not limited to what [Porter \(1985\)](#) calls supporting activities, i.e., public relations, IT, legal and human resources. For the purpose of this paper, we focus on the following three core elements along the insurance value chain (see also [Eling and Lehmann 2018](#)):

1. Product development, marketing and sales, with a focus on product development,
2. Risk management and underwriting,
3. Operations and claims management, including aspects of procurement and servicing.

In the following, we review these three areas of value creation indicating the status of the current sustainability discussions among academics and insurance practitioners. This enables us to group sustainability considerations in those fields of the profession and form a roadmap for insurance executives. Finally, we suggest possible sustainability metrics that allow to monitor the status and progress of the journey along the roadmap.

#### 3.1. Product Development, Marketing and Sales

Sustainable insurance solutions are not entirely new. A review by [Mills \(2009\)](#) of 244 insurers and related organizations globally found 643 real-world examples in the products and services category. More recently, [Fey \(2021\)](#) reviewed the Swiss insurance sector for green products and found various examples ranging from premium rebates for electric vehicles to specific insurance solutions for photovoltaic or geothermal power generations. We report a selection of such product features in Table 1.

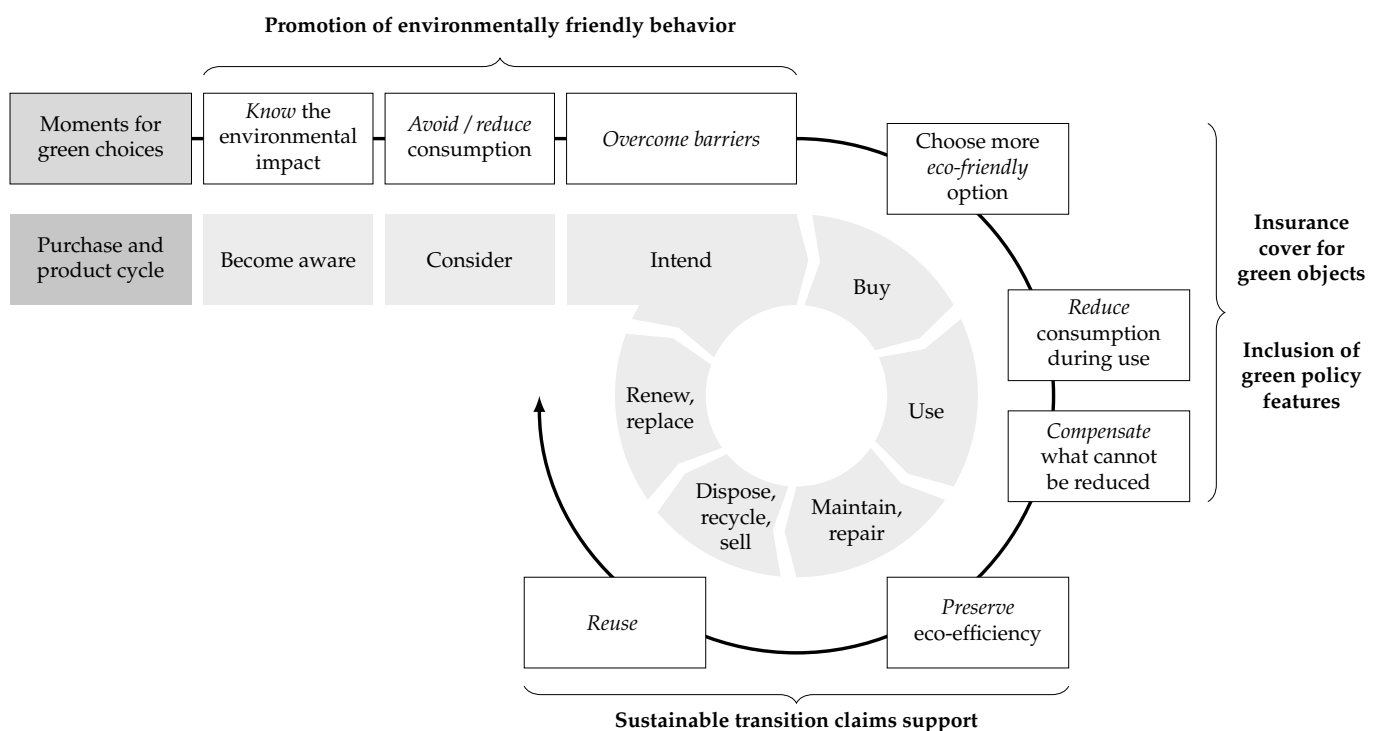
**Table 1.** Examples of product features published by Swiss insurers in annual reports as of 2021 (adapted from [Fey 2021](#)).

Company	Product Features
Baloise	<ul style="list-style-type: none"> <li>– CO<sub>2</sub> compensation for policyholders possible</li> <li>– Expansion of the electric vehicle charging infrastructure</li> </ul>
Helvetia	<ul style="list-style-type: none"> <li>– Premium discounts for electric vehicles</li> <li>– CO<sub>2</sub> compensation for policyholders possible</li> <li>– Insurance for photovoltaic systems and geothermal probes</li> </ul>
Mobiliar	<ul style="list-style-type: none"> <li>– Premium discounts for electric vehicles</li> <li>– Focus on repairing instead of a replacing items</li> <li>– Insurance for photovoltaic systems</li> <li>– Emphasis on preventive measures</li> </ul>
Zurich	<ul style="list-style-type: none"> <li>– Premium discounts for electric vehicles</li> <li>– Insurance for photovoltaic, geothermal and similar systems</li> <li>– Parametric insurance solutions</li> <li>– Emphasis on insurance solutions for innovative companies and technologies dealing with the reduction and storage of CO<sub>2</sub></li> </ul>

Nevertheless, there is no clear-cut definition for green insurance products available yet. Instead, several emerging non-binding regulations and standards (see, for example, [SASB 2018](#); [SIA 2020](#); [TCFD 2021](#); [UNEPI and PSI 2020](#), among many others) can be observed. These are only slowly evolving into a more unified industry framework, and as such can be confusing, especially for smaller insurance companies. What is more, the definition of green products will be largely shaped by external perception of the public, investors, regulators and consumers, requiring an outside-in view in the product development process as well.

**Product development, marketing and sales roadmap.** Insurance is a promise and as such an intangible product. Except for the paper (if any) the contract is written on, there are no direct emissions attached to its production. The “greenness” of an insurance product is therefore linked to the object or activity that is insured. Thus, the fulfillment of the promise, the claims handling, becomes much more material. We separately discuss its impact on sustainability in Section 3.3. Taking into account the life cycle of an insured object or activity, and the choices consumers make along its way, the roadmap for green insurance products consists of four major aspects (see also Figure 1) and one overarching dimension:

1. *Insurance cover for green objects.* Cover of green insurance objects with specific tariffs to promote eco-friendly objects.
2. *Inclusion of green policy features.* Adding green insurance features to conventional objects or activities, as part of the core product or related service, or as independent service. Products or services can cater for specific sustainability themes or related risks.
3. *Sustainable transition claims support.* Support of the sustainability transition after a claim with ecological repair, replacement, or upgrades (see Section 3.3).
4. *Promotion of environmentally friendly behavior.* Set up of incentives, ecosystems and communication to promote environmentally friendly behavior, characteristics and transition outside a claim.
5. *Dialogue with customers.* Lead regular dialogue with customers on critical issues, provide incentives and risk advice to support their risk mitigation and efforts of transition (see Section 3.2).



**Figure 1.** Types of green insurance propositions along the purchasing and product life cycles (adapted from Pugnelli et al. 2022).

Indeed, insurance companies can act on the buying and usage behaviors of products tailored for clean technology and emission-reducing activities (UNEPFI 2007). Incentives come through, e.g., specific cover, tariffs and features (see the moments for green choices in Figure 1), the choice of more eco-friendly options or the reduction of consumption during use. More specifically, when covering green objects or activities, insurers can adjust covers and services to address the specific needs, such as for the batteries and charging cables in the electric vehicles or for the charging station in the garage. Or they can adjust tariffs in favor



of a green product when compared to a conventional one. Thereby insurance premiums recognize eco-friendly objects or behavior. The latter triggers underwriting consideration (see Section 3.2) where the potential effect of customers buying environmentally friendly objects having an advantageous risk profile may justify lower tariffs (see, e.g., [Baecke and Bocca 2017](#); [Swiss Re 2017](#), p. 18; [Eling and Kraft 2020](#)). Overall, a revision of the premium calculation can lead to policies where features promote sustainable or green behavior ([Zona et al. 2014](#)), and incentivize health, safety or environmentally responsible actions or behavior ([SASB 2018](#)). The progress can be measured through written premiums related to energy efficiency and low carbon technology, for example.

Green policy features are building on core insurance products. Some companies currently offer CO<sub>2</sub> compensation for policyholders in cases where certain environmental impacts cannot be reduced (cf. Table 1). A classic example is a travel insurance offering a CO<sub>2</sub> compensation extension. It also includes digitally supported incentives to optimize usage (such as pay-as-you-drive offers) as well as prevention services through telematics (see, e.g., [Swiss Re 2017](#), p. 18) or smart home solutions ([Deloitte 2017](#); [Sevillano 2018](#)) to avoid resource-intensive repairs or replacements. Finally, following the product cycle, client's repair, recycling and renewal processes can be supported through eco-efficient and reuse-oriented incentives.

Insurers can also influence customer behavior early in the life cycle of an insured product or activity. They can acknowledge if the underlying risk is already eco-friendly or transitioning towards being (more) eco-friendly, and propose to cover the design, production and use of sustainable products, or the liability associated with their production and use ([Zona et al. 2014](#)). Communication on the environmental knowledge and consumption best practice can promote environmental behavior. Apart from classical promotion campaigns, this often involves an insurer's participation in a broader business ecosystem, e.g., for shared mobility, green buildings or circular economy offerings.

**Design features for mobility and home insurance.** The focus on green mobility and home insurance products is justified by their interlinkage with many environmental aspects. Life and health products, by contrast, are more linked to social sustainability aspects. In fact, the transportation sector is the largest emitter of greenhouse gases ([IEA 2019](#)) while buildings and their construction account for 35% of global energy and 38% of total global energy-related emissions. Residential buildings (excluding construction) account for 22% of energy and 11% of emissions, respectively ([UNEP 2020](#), p. 4). According to the [IEA \(2019\)](#) neither the residential housing market nor associated housing appliances are transitioning fast enough towards the sustainable development scenario. Electric vehicles, on the other hand, are one of the few technologies on track under that scenario. However, efficiency gains are largely canceled out by consumer preferences for large cars and lower vehicle occupancy rates ([IEA 2019](#)). Insurance product solutions catering to a faster transition are therefore highly relevant. As [Pugnetti et al. \(2022\)](#) note, “green products are but one part of a comprehensive approach towards sustainability along the insurance value chain. An isolated offer that could be interpreted as a symbolic action or selective disclosure might be regarded as greenwashing by consumers. A number of mitigation actions—such as inventory reporting, impact quantification, third-party verification and integration of SDG (Sustainable Development Goals) reporting into internal decision making—contribute to an exhaustive sustainability approach including product development, communication and reporting ([Spors 2021](#); [Verles 2018](#))”. Table 2 provides an overview of design features for motor and home insurance.

On the bottom line, a key question is whether the product or service contributes to a measurable sustainability metric. In fact, as we discuss in Section 3.3, insurance companies must measure the impact of products and services on greenhouse gas emissions, physical risks and transition risks ([TCFD 2021](#)), as well as their impact on companies' sustainability goals (e.g., amount of people benefited, contribution to the sustainable development goals target).

**Table 2.** Examples of sustainable mobility and home insurance propositions (adapted from Allianz and Euler Hermes 2020; AutoSense 2022; Capgemini 2021; Laka 2022; Mills 2009; Sharely 2022; Thingsy 2022; UNEPFI 2007; VCS 2020; Zurich 2022, see also Pugnetti et al. 2022).

Dimension	Mobility Insurance	Home Insurance
<i>Insurance cover for green objects</i>	<ul style="list-style-type: none"> <li>– “Green” behavior discounts for low- and no-emission vehicles</li> <li>– Cover for electric, hydrogen and alternative fuels vehicles</li> <li>– Specific cover for e-scooters</li> <li>– Discount for car insurance policyholders with public transport pass</li> </ul>	<ul style="list-style-type: none"> <li>– Cover and discounts for certified buildings (e.g., LEED, Energy Star)</li> <li>– Discounts linked to risk reduction and property loss mitigation measures (e.g., installations against NatCat impact)</li> <li>– Cover for solar installations and photovoltaic warranty</li> <li>– Cover for eco, self-built homes and alternative builds</li> </ul>
<i>Inclusion of green policy features</i>	<ul style="list-style-type: none"> <li>– “Pay as/how you drive” pricing</li> <li>– Green consumption services</li> <li>– Bicycle cover with club rewards</li> <li>– Compensation of mobility emissions</li> </ul>	<ul style="list-style-type: none"> <li>– Technical, maintenance and warranty support for “green” installations</li> <li>– Renewable energy reimbursement in case of power outage</li> <li>– Consumption-based services; compensation of emissions</li> </ul>
<i>Sustainable transition claims support</i>	<ul style="list-style-type: none"> <li>– Virtual repair or optimized physical repair network</li> <li>– Repairment instead of replacement (e.g., windshield repair)</li> <li>– Transition incentives towards “greener” mobility choice (e.g., replacement upgrade for hybrid or electric vehicles)</li> </ul>	<ul style="list-style-type: none"> <li>– Ecological repair and replacement (e.g., claims handling with used parts to avoid resource consumption)</li> <li>– Eco-friendly replacement material</li> <li>– “Green” building upgrade after loss or for renovations (e.g., allow for rebuilding more sustainable after a loss)</li> </ul>
<i>Promotion of environmentally friendly behavior</i>	<ul style="list-style-type: none"> <li>– Services from partner networks with charging at fixed prices</li> <li>– Mobility ecosystems and services (e.g., joint mobility platform services)</li> <li>– Cover for sharing mobility (e.g., B2B2C partnerships with additional individual covers)</li> </ul>	<ul style="list-style-type: none"> <li>– “Green” building advice</li> <li>– Local NatCat risk information</li> <li>– Smart home solutions with climate impact</li> <li>– Sharing society and circular economy services</li> <li>– Behavioral discounts</li> </ul>

### 3.2. Risk Management and Underwriting

Managing risks is the “raison d’être” for insurance companies. In fact, the ability to select, price, manage and finance risk is the core of the insurance business. Accounting for sustainability risks before risk financing in the underwriting as well as in the risk management process is of significant importance to insurers (Shea and Hutchin 2018). EIOPA (2021, p. 5) states that “the increasing manifestation of climate change risks in the coming years and decades may provide undertakings with strategic opportunities, but also challenge current business models, jeopardizing the long-term risk profile and solvency”. Generally speaking ESG risks are defined as “events or conditions related to environmental, social and governance aspects that if they occur have potential or actual negative impacts on the financial position, performance, reputation of the entity” (BaFin 2019). ESG-related or sustainability risks are not necessarily new. However, both prevalence and attention have accelerated rapidly in the recent past (COSO and WBCSD 2018). Insurers are challenged to consider the potential impact and need to increase their focus on oversight, governance and management of these risks across the organization. Starting with a definition of ESG risks, the focus in this section is on the role and roadmap of the risk management and underwriting function.

**Environmental, social and governance risks.** While there is general agreement in the literature and practice concerning the three ESG factors, only a few authors or institutions

provide a definition of ESG risks. In fact, most international frameworks and standards have refrained from establishing a definition. In consequence, insurers are challenged to outline and communicate their understanding of ESG risks depending on the own business model. However, we can retain that ESG risks are commonly understood as financial and non-financial impact driven by three aspects (cf. [COSO and WBCSD 2018](#); [EBA 2020](#); [UNEPFI and PSI 2020](#)): First, *environmental* (E) issues relate to the quality and functioning of the natural environment and natural systems. Second, *social* (S) issues relate to the rights, well-being and interests of people and communities. Third, *governance* (G) issues relate to the governance of companies and other entities. For illustration, we provide a characterization of ESG risks in Table 3.

**Table 3.** Characterization of ESG risks (adapted from [BaFin 2019](#); [COSO and WBCSD 2018](#); [EBA 2020](#); [EIOPA 2019](#); [Pfeifer and Langen 2021](#)).

Issues	Description
Environmental	<ul style="list-style-type: none"> <li>– Climate mitigation and adjustment to climate change</li> <li>– Protection of biodiversity</li> <li>– Sustainable use and protection of water and maritime resources, sustainable land use</li> <li>– Transition to a circular economy, avoidance of waste and recycling</li> <li>– Avoidance and reduction of environmental pollution, protection of healthy ecosystems</li> </ul>
Social	<ul style="list-style-type: none"> <li>– Compliance with recognized labor standards (no child labor, forced labor or discrimination)</li> <li>– Compliance with employment safety and health protection</li> <li>– Appropriate remuneration, fair working conditions, diversity, training/development opportunities</li> <li>– Trade union rights and freedom of assembly</li> <li>– Guarantee of adequate product safety, including health protection</li> <li>– Application of the same requirements to entities in the supply chain</li> <li>– Inclusive projects and consideration of the interests of communities and social minorities</li> </ul>
Governance	<ul style="list-style-type: none"> <li>– Tax honesty and anti-corruption measures</li> <li>– Sustainability management by the board, board remuneration based on sustainability criteria</li> <li>– Facilitation of whistle blowing, employee rights guarantees</li> <li>– Data protection guarantees and information disclosure</li> </ul>

ESG risks in our view are not a subcategory of emerging risks because some already have an impact, such as physical damage caused by environmental risks. [EIOPA \(2019\)](#) defines sustainability risks as “risks that could affect the insurance and reinsurance undertakings’ risk profile, on the investments and liabilities side, due to ESG factors”. [BaFin \(2019\)](#) expands on the type of impact and defines ESG risks as “events or conditions related to environmental, social and governance aspects that if they occur have potential or actual negative impacts on the financial position, performance, reputation of the entity”.

**Climate change risks.** The focus of the insurance industry and of this contribution is on climate risks. Typically, climate change risks are divided into two groups ([CRO Forum 2019](#); [Golnaraghi 2021](#)). The first group encompasses *physical* risks related to actual climate change and the impact on the value of assets and liabilities. They can be driven by events or longer-term shifts in climate patterns. Second, there are *transition* risks seen as uncertain consequences of the transition to a sustainable, low-carbon economy such as public policies, regulations, technological advancement, market conditions and other aspects of societal transition that affect the level of climate change risk and the future risk landscape. Transition risks also include climate-related litigation and legal risk ([Golnaraghi et al. 2021](#)).

These risks impact insurers to a diverse and potentially severe extent as insurers underwrite and accept diverse risks of their customers. Adapting the risk appetite and underwriting process and guidelines is therefore of utmost importance for an insurance company. While most importance is currently put on understanding the impact of extreme weather events ([Golnaraghi 2021](#); [Golnaraghi et al. 2021](#); [Swiss Re Institute 2021](#)), mitigating



the potential impact of many other events or conditions on assets and liabilities needs to be considered. [DAV \(2021\)](#) provides the following examples:

- Higher rates of morbidity and mortality due to a climate-related rise in air pollution, leading to higher life and health insurance claims.
- Rising sea level leads to decreasing values of real estate investments near coasts or in government bonds of strongly exposed countries.
- Transition to low-carbon economy reduces demand for products of an important customer segment, leading to shrinking premium and potential reputational loss.
- A natural catastrophe occurs simultaneously to falling market values of investment and increasing reinsurance prices.
- Business interruption, unexpected regulatory changes, damage to infrastructure as a consequence of natural catastrophe lead to service issues and expense increase.
- Due to lack of ESG know-how and awareness, customer or partner relationships with critical exposures are not identified or regulatory rules not complied with. Rating agencies may punish the company with a poor rating, which in turn leads to decreased customer and investor demand.
- The company misses aligning its products to changing environment and customer needs (i.e., lack of product development for new forms of work and lifestyles).

A good understanding of the exposure of ESG risks to an insurers' assets and liabilities is a prerequisite to developing the company's risk appetite. Best practice is to involve different functions, above all of underwriters and risk managers ([UNEPFI and PSI 2020](#)), to understand and integrate sustainability issues into the organization. Running scenarios to assess impacts and inform strategy and decision-making is the common approach ([CFRF 2020](#); [EIOPA 2019](#); [MAS 2020](#); [NGFS 2021](#)). Scenarios, however, should not only include direct effects but also consider that many losses such as weather-related losses are not insured. This protection gap can lead to a significant burden on households, businesses and governments that cascades to insurers. Several institutions—the Casualty Actuarial Society ([Conning 2020](#)), the Climate Financial Risk Forum ([CFRF 2020](#)), the Geneva Association task force on climate change risk assessment ([The Geneva Association 2022](#)), the Network for Greening the Financial System scenarios portal ([NGFS 2022](#)), the Task force on Climate-related Financial Disclosure knowledge hub ([TCFD 2022](#))—work on advancing the development of methodologies and scenarios that help entities to understand the impact of ESG risks. The ESG Guide by [UNEPFI and PSI \(2020\)](#), the [COSO and WBCSD \(2018\)](#) enterprise risk management guide and the [CRO Forum \(2021\)](#) provide key questions and recommendations that help insurers to establish their risk appetite. [Pfeifer and Langen \(2021\)](#) outline an appropriate and efficient approach for small- and medium-sized insurance companies that lack the resources of large multinationals.

**Risk management roadmap.** Each organization will need to balance objectives such as risk and return, costs and benefits, as well as short and long-term perspectives. The choice of an ESG approach is guided by strategy and implemented operationally, and needs to be embedded in the risk and policy framework of the insurance company. The following steps outline a risk management roadmap (based on [BaFin 2019](#); [EBA 2020](#); [EIOPA 2019](#); [Golnaraghi 2021](#); [MAS 2020](#); [UNEPFI and PSI 2020](#)):

1. *Integration of sustainability in risk leadership and analysis.* Lead ESG integration with tone from the top, put sustainability on board and committee agendas, nominate senior manager to lead related initiatives and align incentives. Update decision-making and escalation procedures. Review and analyze risks related to the business model against the background of sustainability issues by involving different functions such as risk, underwriting, actuarial and others as well as by running scenarios. Opt for forward-looking approaches to identify, assess and manage risks. Recruit and train staff with expertise to identify, assess and manage (emerging) ESG risks.
2. *Review of global risk objectives.* Include financial and non-financial ESG objectives in risk appetite and key performance indicators. Formulate and communicate the risk

strategy and the related risk appetite, and foster discussion, awareness and expertise across the organization.

3. *Definition of local tolerance levels.* Translate global risk appetite into local risk categories and tolerance levels and build a resilient business model supported by an adequate governance framework. Operationalize risk appetite into actionable targets, limits and control framework.
4. *Risk monitoring and reporting.* Ensure ESG risks are in the scope of audits. Monitor proportionality as well as the effectiveness of the three lines of defense and escalation procedures. Foster expertise, accountability and dialogue across the organization. Include sustainability risks in internal and external risk reporting (Deloitte 2021). Communicate, disclose risks and actions and seek dialogue with internal and external stakeholders and experts. Maintain consistency between ESG and other reporting; monitor international reporting frameworks and guidelines.
5. *External environment monitoring.* Monitor legal and economic environment for external risk factors, collaborate with external stakeholders for best practice responses, data insights and modeling.

**Underwriting roadmap.** Similar to the developed criteria related to sustainable investing, the PSI outlined by UNEPFI and PSI (2020) guide insurers on how to approach the integration of sustainability challenges. In regards to underwriting, UNEPFI and PSI (2020, p. 12) notes that the “integration into the underwriting standards and guidelines of the organization often allows the best uptake of ESG issues and, at the least, might cross-reference any additional ESG governance elsewhere”. Based on a survey among surety underwriters, Shea and Hutchin (2018) note that most company guidelines are too generic and that many underwriters would welcome more effective guidelines to integrate ESG risk in their assessment. They further note that underwriters judge the societal response to many ESG factors as underdeveloped. The following key steps outline the underwriting roadmap (based on Allianz and Euler Hermes 2020; Nogueira et al. 2018; UNEPFI and PSI 2020):

1. *ESG due diligence.* Undertake due diligence to identify ESG and reputational issues in current underwriting portfolios; involve experts from underwriting, risk management, actuarial and other relevant functions.
2. *Assessment criteria and metrics.* Within the risk appetite framework, define exclusion and dedicated assessment criteria (i.e., not insuring selected industries, such as controversial weapons or applying dedicated assessment methods to identified others, such as coal mines); external sources might help develop the metrics (see UNEPFI 2022a or Allianz 2021).
3. *Inclusion of sustainability in risk assessment.* Include ESG factors in risk assessments; provide the tools to access ESG risk-related information relevant for underwriting; source resources externally if necessary.
4. *Definition of decision-making processes.* Define thresholds for single-case decision making and escalation routes; mitigate over-burdening of decision-makers.
5. *Delivery of ESG expertise.* Beyond the dialogue with customers (see Section 3.1), deliver ESG expertise as well as insurance solutions covering externalities of customers during the transition towards sustainable business practice.

When revising assessment criteria, the focus should not only be laid on exclusions or additional due diligence processes but also on opportunities for positive risk selection. Gambetta et al. (2021), for example, found that financial institutions that contribute more to sustainability goals portray a balanced risk profile. Some exclusions may apply, for example, for mining companies and for electricity supply companies in which the proportion of electricity generation attributable to coal exceeds a defined level (SIA 2020). Nevertheless, a categorical exclusion of any risks with ESG exposure is not conducive of the goal to transition to more sustainable business practices and also neglects business opportunities for insurers (cf. Allianz and Euler Hermes 2020; Nogueira et al. 2018). Rather, insurers can play an important role in influencing customers by, for example, rewarding sustainable production methods in their risk pricing, by supporting customers with insurance solutions

in their transition and by providing the risk management expertise to mitigate risk, as outlined in Section 3.1.

### 3.3. Operations and Claims Management

In operations and claims, the efforts to become greener can be summarized in the goal of achieving carbon neutrality. At first sight, this seems viable, as insurance operations, mostly offices, are no big polluters. The picture changes somewhat when all up- and downstream emissions are included. Insurers spend a considerable share (60–80%) of their income on claims payments. In property and casualty insurance, a relevant part of that expense goes to contractors doing repairs or to suppliers providing replacements for insured objects that are damaged or lost. Compared to emissions directly caused in the reporting unit, such indirect emissions can be tricky to measure, and the reduction of emissions is not entirely in the company's hands. A useful resource to support a systematic approach for keeping an inventory of greenhouse gases (GHGs) is provided by the ISO 14064 standard.

**Greenhouse gas emissions.** The GHG protocol, established in 1998, is the most commonly used framework (WRI and WBCSD 2022) to report emissions. It differentiates three types of emissions:

- Scope 1: all direct emission generated in the operation of the reporting company;
- Scope 2: all indirect emissions from purchased electricity, gas and steam;
- Scope 3: all other indirect up- and downstream emissions not covered by scope 2.

The protocol normalizes all gases emitted relative to their global warming potential on a 100-year basis, a standard defined by the 2013 Warsaw meeting of the UN Framework Convention on Climate Change based on the second and fourth IPCC reports (IPCC 1995, 2007). The resulting metric is called the CO<sub>2</sub> equivalent, with CO<sub>2</sub> set at one, compared to methane at 25. These values are still used, albeit not undisputed by science. It exemplifies that standards, while important for creating a common language for collaboration, are still in development mode.

The GHG scope 2 emission protocol provides guidance on measuring and reporting the use of, in the case of insurers, mostly electricity. It distinguishes two allocation methods, the location based and the market based. In the location-based method, emissions through consumption of electricity are reported based on the average emission intensity of the grid on which the consumption occurs. The market-based method allows to reflect specific contractual agreements with utility suppliers that the reporting company has chosen. Insurers that have publicly declared a zero-emission target often refer to the RE100 initiative led by the Climate Group. Its objective is to achieve a 100% share in renewable electricity consumption where certification is provided via a partnership with the Carbon Disclosure Project (see Climate Group and CDP 2022).

Once a baseline is established, the next step is to set reduction targets. To ensure credibility and to avoid accusations of using the topic as a marketing spin to just appear environmentally friendly (so called greenwashing), it is again useful to apply accepted standards. A widely used framework is provided by the Science Based Target initiative (SBTi 2022), part of the World Resource Institute's (WRI) Center for Sustainable Business and a collaboration of the WRI, CDP, WWF and UN Global Compact (see also UNGC 2020). The SBTi ensures that private sector targets are linked to the ambition of the Paris agreement of keeping the temperature increase well below 2 °C compared to pre-industrial levels. It provides target setting methods and the independent assessment and validation of targets. Targets set under the SBTi must include a base and the target year (5 to 15 years from the base year), be aggressive, i.e., beyond business as usual in an organization's sector and aim for an absolute reduction in GHG emissions, covering global operations in their geographic boundaries. Provided scope 3 emissions account for more than 40% of the total, they must address all three emission scopes. While SBTi demands ambitious targets, they must go hand in hand with a realistic action plan.

A (non-representative) sample review of annual sustainability reports of European insurance companies (Allianz 2021; Axa 2020; Swiss Re 2021; Zurich 2021) indicates that two

thirds or more of all emissions reported under the GHG protocol are in scope 3 emissions. A significant part of scope 3 emissions is related to insured property being replaced or repaired in case of damage or loss. Global property insurance premiums, excluding comprehensive motor insurance, is estimated to amount to USD 450 billion in 2020 (Howard 2021). Premiums for motor insurance are estimated at USD 766 billion but cover personal injury as well. A back-of-the envelope calculation, applying a 70% loss ratio on property premiums, shows that materials worth USD 250 billion are affected with a similar magnitude on motor insurance to be added. The way these expenses are handled is a considerable lever. Allianz (2021), for instance, in its 2020 sustainability report, states that procurement teams in the UK have focused on influencing customer demand through a motor claims process piloting a “restore over replace” philosophy in partnership with suppliers. The typical approach for procurement in such cases is to apply a vendor code of conduct, not only including carbon footprint aspects (as certified by ISO standards 14001 and 50001) but also social standards such as defined by the International Labor Organization. Table 4 includes a few illustrative examples of key performance indicators, related actions and useful standards or resources.

**Table 4.** Illustrative examples on key performance indicators, related actions and frequently referred-to standards and certifications.

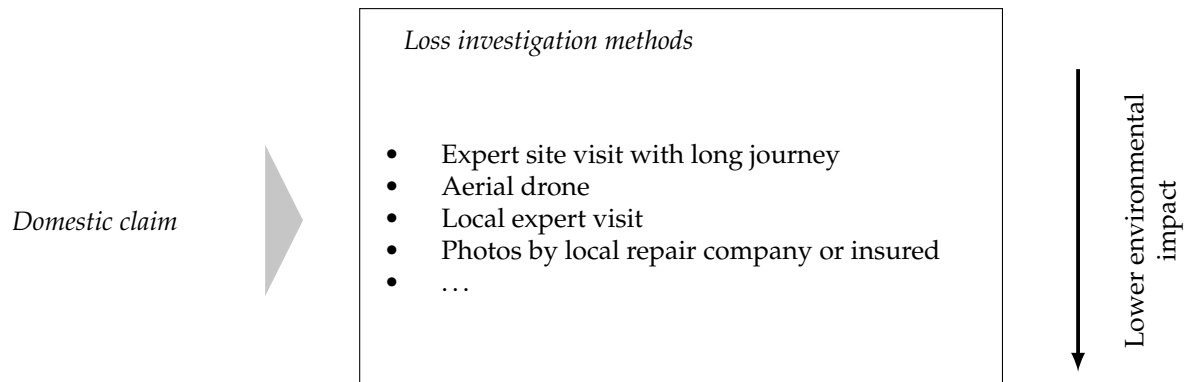
Type of Emissions	Key Performance Indicator	Potential Related Actions	Standards and Certifications
Scope 1	Onsite heating emissions	– Thermal insulation of office buildings	LEED certification
	Fleet emissions	– Switch to electrical fleet	OEM standards
Scope 2	Share of renewable energy	– Negotiate agreement with utilities	RE100 initiative
		– Compensation measures where needed	
Scope 3	Emissions from travel	– Introduce internal carbon levy – Consider digitally supported loss investigation methods (see Figure 2)	UN Global Compact
	Emissions from suppliers (such as paper suppliers, data centers, repair workshops)	– Include ESG criteria in vendor management – Compensation measures where needed	ISO 14001, ISO 50001
	Emissions from employee commutes	– Home office policy – Incentives for employees supporting use of public transport or electrical vehicles – Limitation of parking lots in offices	n.a.

Note: The abbreviation “n.a.” stands for not available.

Regarding insurance claims management, an example for reducing emissions from a large part of business travel is the use of image recognition technology in loss investigations (see Figure 2). Site visits by experts often come with long journeys to the customers. Thanks to technological progress, these investigations can be replaced in many cases by photos or videos directly sent by the insured or through a local repair company or a local expert. The latter come with a lower environmental impact.

A controversial debate in the zero-emission pledge is the question of emission compensation. Carbon offsetting programs have been available on the market for many years and offer a simple, if not inexpensive, way to reduce one’s carbon footprint. However, the quality of these compensations is often disputed due to verification challenges and the danger of double counting reductions that would have taken place anyway (e.g., forests growing naturally). More progressive corporations therefore adopt two approaches to this topic: they prioritize their own reduction activities, limiting compensation to areas with no other viable options, and they prioritize active carbon removal measures to compensate, despite their significantly higher price. As an illustrative example of the second point,

Swiss Re uses an internal carbon steering levy to finance external carbon removal certificates (see [Swiss Re 2021](#)). Those include a USD 10 million deal with Climeworks that captures and stores carbon dioxide from the air. Many international insurance and reinsurance companies have joined the pledge for a zero-emission target over the last years. For small- and medium-sized companies, a challenge lies in the considerable effort in measuring and reporting activities. The standards mentioned, as much as they are still in a flux, may help to reduce that effort.



**Figure 2.** Environmental impact of different loss investigation methods.

**Operations and claims management roadmap.** The four-step approach suggested here is not a novelty to many insurance operations practitioners:

1. *Sustainable leadership program accompaniment.* Accompany operations with a sustainable leadership program (see, e.g., [Brand and Winistörfer 2017](#)). Such a program must encompass the full portfolio of operational activities, including claims and associated indemnity management.
2. *Greenhouse gas emissions inventory.* Build up an inventory of GHG emissions encompassing all core operational and claims processes. Apply standards such as ISO 14064.
3. *Baseline metrics.* Measure the baseline, e.g., by applying the GHG protocol. Address scope 1–3 emissions and involve key third party providers.
4. *Meaningful targets and associated actions.* Set meaningful targets and define actions, e.g., by applying the SBTi principles. To mitigate claims of greenwashing, apply commonly accepted standards such as SBTi.
5. *Progress measurement, actions on deviations and reporting.* Measure progress, act on deviations from targets and report outcomes, e.g., by applying global reporting standards ([GRI 2022](#)).

What may be new, though, is that this transformation requires the involvement of all parts of an organization to be successful. Even more, as we see in Section 4, it requires the involvement of numerous outside parties.

#### 4. Discussion

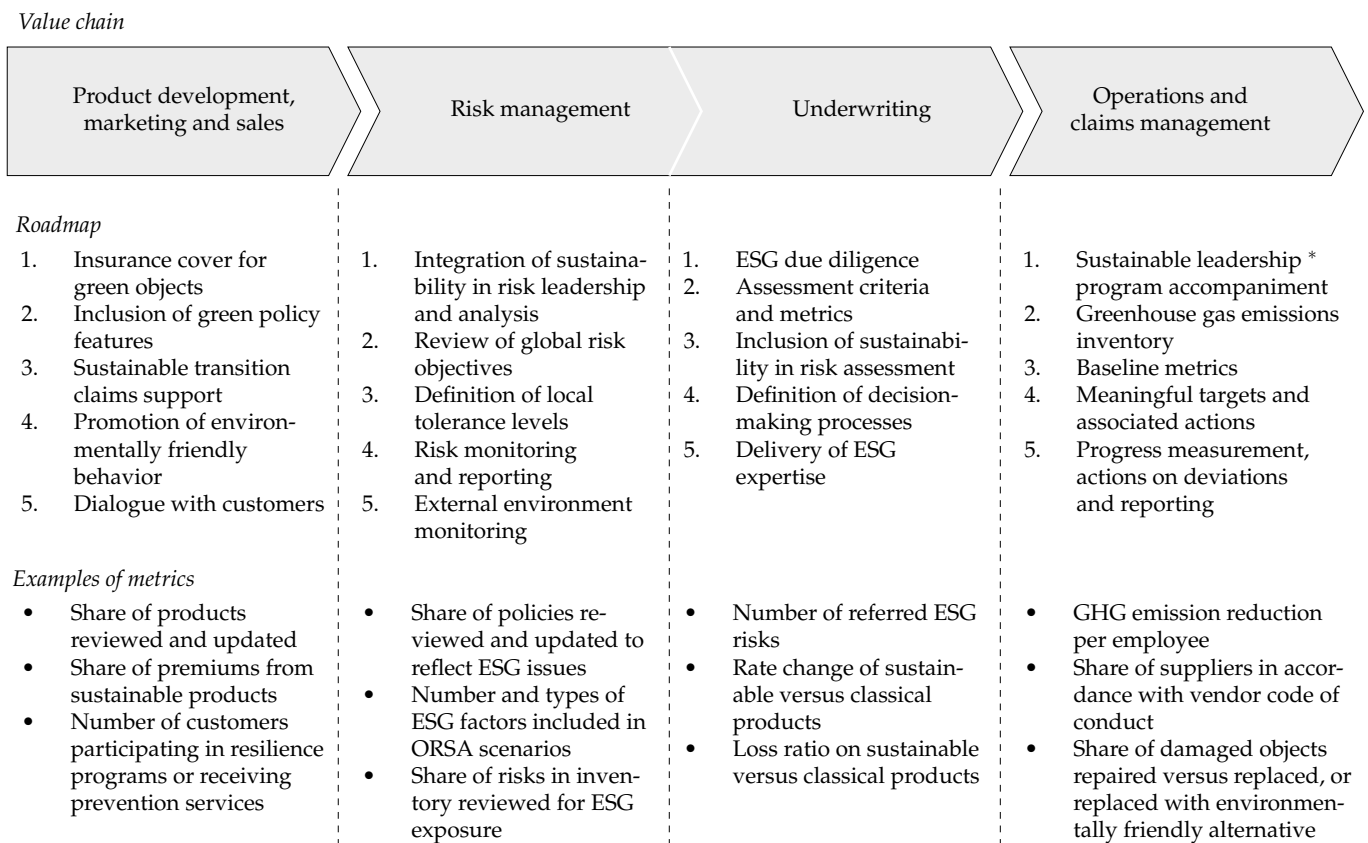
Climate change is likely to have a potentially material and irreversible impact over multiple time horizons, however uncertain we may be about the details of this impact. Insurers not only need to review their investment strategy but also assess the potential impact on the core insurance business and operations. In addition, societal, regulatory and customer expectations are rising, and insurers are increasingly expected to take a more active role. However, complex interdependencies, non-linear effects and negative externalities complicate adequate pricing of ESG risks. This complexity extends to the need for and potential effects of operational changes. Model risk is present, data is scarce and the time horizon often does not match that of other managerial instruments and processes. Hence, the argument that the current insurance value chain and governance frameworks are effective and efficient enough is increasingly being replaced by an understanding that new practices are necessary. [Brand and Winistörfer \(2017\)](#) propose a management system



model for corporate responsibility which provides a useful framework for setting up and running a successful sustainability program.

Moreover, the [UNEPFI and PSI \(2020\)](#) argue that “the benefits for companies taking an active role in developing an ESG approach not only helps mitigate reputation risk to their organizations and manage societal expectations but will also help them capitalize on developing understanding of the financial benefits of clients with strong ESG performance”. Research shows though that programs for sustainability are “not a strategy for the half-committed” ([Cappucci 2018](#)).

Bluntly spoken, just charging more premium to compensate the increase in natural disaster losses is not a sustainable solution. Our review of the value chain showed that it is crucial for insurers to not only build resilience but to take an active role and a forward-looking approach. The roadmap depicted in [Figure 3](#) summarizes the key findings of [Sections 3.1–3.3](#) and may help facilitate the start of the transition, especially for small- and medium-sized insurance companies that cannot afford dedicated research and staff functions.



**Figure 3.** Roadmap and metrics along the core elements of an insurance company’s value chain.

Overarching themes across all steps of the value chain and encompassing key partners are (1) to analyze the current position and exposure in regards to sustainability issues, (2) to update strategic and functional goals and responsibilities to set the tone from the top, (3) to formulate actions and metrics to make the transition binding and finally (4) to measure and report progress to inform and support the organization on the journey. While the focus in product development lies in standardizing green policy features, marketing and sales will be concerned with increasing the share of premium generated from clients with sustainable business practices. Risk management will need to provide the necessary guidance and framework to transition business investments into greener assets and liabilities while underwriting will have to reflect sustainability criteria in risk assessment considerations.

By reducing and reporting their own footprint, insurers gain the expertise and position to consult their clients and suppliers, not least in how to handle claims in an ecofriendly way.

Insurance companies of all sizes embarking on their sustainability journey need to consider the complex (in the systemic sense of “non-linear” and thus unpredictable) nature of the journey when charting the course for its implementation. Specifically, they need to be aware that:

- The journey needs to start without clear line of sight of the endpoint. The implied necessity for frequent and potentially substantial corrections along the way cannot, however, be an excuse for delaying the start to a time of greater clarity. The systemic characteristics of delayed reaction time, positive feedback loops and potential tipping points due to non-linearity inherent to climate change do not allow for that luxury.
- The journey also needs to start with the acceptance by its initiators that they will most likely not see it through to the end, simply because the journey will take much longer to complete than their individual tenure in the company will. This poses a challenge in that individual incentives and typical managerial cycles are not per se aligned with overall objectives.
- It adds many stakeholders and governance aspects to consider in the internal decision-making process, increasing the risk of over-steering or paralysis of the organization itself, as well as a high potential for frustration or disillusionment, resignation or even cynicism on the way.
- It requires collaboration across silos and beyond the borders of one’s own organization, exposing what used to be considered “internal matters” to the public and hence demanding a clear strategy to manage the public perception as well as regularly confirming employees’ and investors’ buy-in.
- It requires both a clear top-down leadership and local execution. It also requires the ability to quickly react to external influences and events and to new facts and targets. As such, it brings to the forefront agility, diversity and resilience, much discussed in the current digital transformation literature.

Extending the purpose of an organization towards the “triple bottom line”—profit, people and the planet—inevitably creates potential conflicts of interest at all levels (Elkington 1999). Rather than ignoring them in an enthusiastic rush towards sustainability, it will be key to recognize them, build them into the design of governance and give guidance to people involved in daily management on how to deal with situations where previously profit-driven decisions are now challenged by sustainability considerations. One way to systematically consider the people and planet dimensions in every-day, profit-oriented decisions taken by insurance professionals is to learn from the risk management practices which aim to optimize risk–return trade-offs. In such a framework, a “sustainability price tag” is attached to every decision. This may change the picture even from a pure profit standpoint. The challenge is to develop a comprehensive model which includes external risk factors, and yet can be applied sufficiently easily.

The roadmap is to be interpreted against some limitations. We acknowledge that the recommendations can only guide insurers in steps to be taken across the value chain and cannot be used as a ready-to-implement checklist. For that, more in-depth analysis will be required in each segment of the value chain. Moreover, the examples provided will quickly be complemented by new approaches. Hence, insurers are challenged to develop their own answers to address sustainability issues, which might be a difficult task for smaller insurers lacking the resources. Targeted focus groups may be useful for defining respective sets of metrics with the potential to evolve into standards that can be used across individual insurance companies, fostering transparency and best practice exchange. We leave these questions open for future research on sustainability transformation in insurance.

## 5. Conclusions

This paper initially developed from an intensive exchange between academia and insurance practitioners in preparing an executive education program entitled “Leading the

Green Insurance Revolution” in 2021. It made sense to structure the program along the insurance value chain. Doing so forced us to be both specific in our own field of expertise while also maintaining a comprehensive and systemic view, considering inputs received from upstream, own activities and outputs passed on downstream to the next element in the value chain. Given the rather alarming situation and the non-linear characteristics of the underlying system, the climate, we conclude that waiting to start the green transformation journey until all of its element become clear is a luxury we cannot afford. The time for the insurance industry to act as good citizens and rational decision-makers is now. Irrespective of the currently neutral public perception, insurers need to prepare for a journey that will be both complex in nature as well as long-lasting in its duration. We suggest that by adjusting one’s business model to sustainability requirements, early movers can expect to capitalize on substantial market opportunities.

To initiate the journey, we propose a comprehensive roadmap, especially for smaller insurance companies, aimed at giving direction and setting priorities while not claiming to provide all answers to its implementation challenges. The roadmap summarizes the main findings along an insurance company’s value chain and highlights the key steps to be covered when starting the transition towards green insurance. Given the share of claims payments and the related amount of indirect GHG in the insurance business, operations and claims management are important levers for the transition. We also note that in all areas it is key to integrate sustainability into the company’s leadership culture. Finally, to measure the progress along the journey it is critical to define appropriate quantitative indicators.

How to manage a transformation that in its nature is all-encompassing, complex and often in contrast to established, profit-oriented practices without running out of steam on the way is a challenge definitely worthy of further in-depth and interdisciplinary research. The challenge posed by this transformation and its societal impact also provides a rare opportunity for insurance companies to actively cooperate and exchange operational best practices for the overall benefit of society, further fulfilling the role of insurance as a public good. For insurance as an industry to succeed in this role, active participation and support by insurance and actuarial associations as well as regulators will be key, not least in supporting the process of consolidating sustainability definitions, reporting standards and metrics so that an effective exchange across the industry is fostered, also, especially, to the benefit of smaller insurance companies.

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## Abbreviations

The following abbreviations are used in this manuscript:

ESG	Environmental, Social and Governance
GDP	Gross Domestic Product
GHG	Greenhouse Gases
ISO	International Organization for Standardization

ORSA	Own Risk and Solvency Assessment
PSI	Principles of Sustainable Insurance
SBTi	Science Based Target initiative
SDG	Sustainable Development Goals

## References

- Allianz. 2021. *Allianz Group Sustainability Report 2020: Collaborating for a Sustainable Future*. Technical Report. Munich: Allianz SE.
- Allianz, and Euler Hermes. 2020. *Impact Underwriting: Sustainable Insurance as an Opportunity for Society and Business*. Technical Report. Munich and Paris: Allianz Research and Euler Hermes Economic Research.
- AM Best. 2020. *Insurers and Reinsurers: Ignoring ESG Factors Poses Reputational Risk*. Technical Report. London: A.M. Best Company.
- AutoSense. 2022. *AutoSense Functions*. Available online: <https://en.autosense.ch/funktionen> (accessed on 16 May 2022).
- Axa. 2020. *2020 Climate Report*. Technical Report. Paris: Axa Group.
- Baecke, Philippe, and Lorenzo Bocca. 2017. The value of vehicle telematics data in insurance risk selection processes. *Decision Support Systems* 98: 69–79. [\[CrossRef\]](#)
- BaFin. 2019. *Merkblatt zum Umgang mit Nachhaltigkeitsrisiken*. Technical Report. Frankfurt: Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin).
- Bouakez, Hamed, Omar Rachedi, and Emiliano Santoro. 2022. The Government Spending Multiplier in a Multi-Sector Economy. *American Economic Journal: Macroeconomics*. [\[CrossRef\]](#)
- Brand, Fridolin S., and Herbert Winistörfer. 2017. *Corporate Responsibility Management, SML essentials Volume 06*, SML Essentials 06 ed. Zurich: Schulthess.
- Capgemini. 2021. *How P&C Insurers Can Protect and Power Our Journey to a More Sustainable World*. Technical Report. Paris: Capgemini Invent.
- Cappucci, Michael. 2018. The ESG Integration Paradox. *Journal of Applied Corporate Finance* 30: 22–28. [\[CrossRef\]](#)
- CFRF. 2020. *Climate Financial Risk Forum Guide 2020: Scenario Analysis Chapter*. Technical Report. London: Climate Financial Risk Forum (CFRF).
- Chiaromonte, Laura, Alberto Dreassi, Andrea Paltrinieri, and Stefano Piserà. 2020. Sustainability Practices and Stability in the Insurance Industry. *Sustainability* 12: 5530. [\[CrossRef\]](#)
- Climate Group and CDP. 2022. RE100. Available online: <https://www.there100.org/> (accessed on 16 May 2022).
- Conning. 2020. *A User's Guide to Economic Scenario Generation in Property/Casualty Insurance*. Technical Report; Research Papers. Arlington: Casualty Actuarial Society.
- COSO and WBCSD. 2018. *Enterprise Risk Management: Applying Enterprise Risk Management to Environmental, Social and Governance-Related Risks*. Technical Report. New York: The Committee of Sponsoring Organizations of the Treadway Commission (COSO) and World Business Council for Sustainable Development (WBCSD).
- Credit Suisse. 2017. *Global Wealth Report 2017*. Technical Report. Zurich: Credit Suisse Group.
- CRO Forum. 2019. *The Heat Is on: Insurability and Resilience in a Changing Climate*. Technical Report. Amsterdam: CRO Forum.
- CRO Forum. 2021. *Mind the Sustainability Gap: Integrating Sustainability into Insurance Risk Management*. Technical Report. Amsterdam: CRO Forum.
- DAV. 2021. *Berücksichtigung von ESG-Risiken im Risikomanagement*. Technical Report. Köln: Deutsche Aktuarvereinigung (DAV).
- Deloitte. 2017. *The Insurer's Playbook on Smart Home—Point of View*. Technical Report. London: Deloitte.
- Deloitte. 2021. *Environment, Social, and Governance Considerations: Corporate Reporting and Assurance Basics*. Technical Report. Deloitte Global. Available online: [https://www.iasplus.com/en-ca/publications/publications/2021/environment-social-and-governance-considerations-corporate-reporting-and-assurance-basics?set\\_language=en-ca](https://www.iasplus.com/en-ca/publications/publications/2021/environment-social-and-governance-considerations-corporate-reporting-and-assurance-basics?set_language=en-ca) (accessed on 16 May 2022).
- EBA. 2020. *Discussion Paper: On Management and Supervision of ESG Risks for Credit Institutions and Investment Firms*. Technical Report. Paris: European Banking Authority (EBA).
- EIOPA. 2019. *Technical Advice on the Integration of Sustainability Risks and Factors in Solvency II and the Insurance Distribution Directive*. Technical Report. Frankfurt: European Insurance and Occupational Pensions Authority (EIOPA).
- EIOPA. 2021. *Opinion on the Supervision of the Use of Climate Change Risk Scenarios in ORSA*. Technical Report. Frankfurt: European Insurance and Occupational Pensions Authority (EIOPA).
- Eling, Martin, and Mirko Kraft. 2020. The impact of telematics on the insurability of risks. *The Journal of Risk Finance* 21: 77–109. [\[CrossRef\]](#)
- Eling, Martin, and Martin Lehmann. 2018. The Impact of Digitalization on the Insurance Value Chain and the Insurability of Risks. *The Geneva Papers on Risk and Insurance—Issues and Practice* 43: 359–96. [\[CrossRef\]](#)
- Elkington, John. 1999. Cannibals with Forks: The Triple Bottom Line of 21st Century Business. *Choice Reviews Online* 25: 42–43. [\[CrossRef\]](#)
- Fey, Fabian. 2021. *Nachhaltigkeit in der Schweizer Versicherungsindustrie*. Master's thesis, ZHAW Zürcher Hochschule für Angewandte Wissenschaften, Winterthur, Switzerland. [\[CrossRef\]](#)
- FINMA. 2019. *Risk Monitor 2019*. Technical Report. Bern: Swiss Financial Market Supervisory Authority (FINMA).
- Gambetta, Nicolás, Fernando Azcárate-Llanes, Laura Sierra-García, and María Antonia García-Benau. 2021. Financial Institutions' Risk Profile and Contribution to the Sustainable Development Goals. *Sustainability* 13: 7738. [\[CrossRef\]](#)



- Gatzert, Nadine, Philipp Reichel, and Armin Zitzmann. 2020. Sustainability risks & opportunities in the insurance industry. *Zeitschrift für die gesamte Versicherungswissenschaft* 109: 311–31. [CrossRef]
- GIM Foresight. 2020. *Sustainability & Brand Management*. Technical Report. Heidelberg: GIM.
- Golnaraghi, Maryam. 2021. *Climate Change Risk Assessment for the Insurance Industry: A Holistic Decision-Making Framework and Key Considerations for Both Sides of the Balance Sheet*. Technical Report. Zurich: The Geneva Association.
- Golnaraghi, Maryam, Joana Setzer, Nigel Brook, Wynne Lawrence, and Lucia Williams. 2021. *Climate Change Litigation: Insights into the Evolving Global Landscape*. Technical Report. Zurich: The Geneva Association.
- GRI. 2022. Resource Center. Available online: <https://www.globalreporting.org/how-to-use-the-gri-standards/resource-center/> (accessed on 16 May 2022).
- Howard, L. S. 2021. Global P/C Premiums Likely to Double by 2040, but Motor Growth Will Slow: Swiss Re. *Insurance Journal*. Available online: <https://www.insurancejournal.com/news/international/2021/09/08/630635.htm> (accessed on 16 May 2022).
- IAIS. 2019. *Global Insurance Market Report [GIMAR] 2018*. Technical Report 7. Basel: International Association of Insurance Supervisors (IAIS).
- IEA. 2019. *Energy Efficiency 2019*. Technical Report. Paris: International Energy Agency (IEA).
- IPCC. 1995. *Second Assessment Report Climate Change 1995*. Technical Report. Geneva: Intergovernmental Panel on Climate Change (IPCC).
- IPCC. 2007. *Fourth Assessment Report Climate Change 2007: Synthesis Report*. Technical Report. Geneva: Intergovernmental Panel on Climate Change (IPCC).
- IPCC. 2021. *Sixth Assessment Report Climate Change 2021: The Physical Science Basis*. Technical Report. Geneva: Intergovernmental Panel on Climate Change (IPCC).
- Khovrak, Inna. 2020. ESG-driven approach to managing insurance companies' sustainable development. *Insurance Markets and Companies* 11: 42–52. [CrossRef]
- Laka. 2022. Cycling Liability Insurance, Legal Cover and Perks. Available online: <https://laka.co/gb/club> (accessed on 16 May 2022).
- MAS. 2020. *Guidelines on Environmental Risk Management (Insurers)*. Technical Report. Singapore: Monetary Authority Singapore (MAS).
- Mills, Evan. 2009. *From Risk to Opportunity 2008: Insurer Responses to Climate Change*. Technical Report. Boston: Ceres.
- NGFS. 2021. *Climate Scenarios for Central Banks and Supervisors*. Technical Report. Paris: Network for Greening the Financial System (NGFS).
- NGFS. 2022. Scenarios Portal. Available online: <https://www.ngfs.net/ngfs-scenarios-portal/> (accessed on 16 May 2022).
- Nobanee, Haitham, Ghaith Butti Alqubaisi, Abdullah Alhameli, Helal Alqubaisi, Nouf Alhammadi, Shahla Alsanah Almasahli, and Noora Wazir. 2021. Green and Sustainable Life Insurance: A Bibliometric Review. *Journal of Risk and Financial Management* 14: 563. [CrossRef]
- Nogueira, Flávio G., André F. P. Lucena, and Roberto Nogueira. 2018. Sustainable Insurance Assessment: Towards an Integrative Model. *The Geneva Papers on Risk and Insurance—Issues and Practice* 43: 275–99. [CrossRef]
- Pfeifer, Dietmar, and Vivien Langen. 2021. Insurance Business and Sustainable Development. In *Risk Management*. Edited by Muddassar Sarfraz and Larisa Ivascu. London: IntechOpen. [CrossRef]
- Porter, Michael E. 1985. *The Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.
- Pugnetti, Carlo, Thomas Gebert, Miriam Hürster, Edward Huizenga, Markus Moor, Lukas Stricker, Herbert Winistörfer, and Angela Zeier Röschmann. 2022. *Leading the Green Insurance Revolution*. Winterthur: ZHAW Zürcher Hochschule für Angewandte Wissenschaften.
- SASB. 2018. *Insurance Sustainability Accounting Standard*. Technical Report. San Francisco: Sustainability Accounting Standards Board.
- SBTi. 2022. Science Based Targets: Ambitious Corporate Climate Action. Available online: <https://sciencebasedtargets.org/> (accessed on 16 May 2022).
- Scordis, Nicos A., Yoshihiko Suzawa, Astrid Zwick, and Lucia Ruckner. 2014. Principles for sustainable insurance: Risk management and value. *Risk Management and Insurance Review* 17: 265–76. [CrossRef]
- Sevillano, Cecilia. 2018. Smart Homes. Paper presented at Swiss Re EMEA Claims Conference 2018, Rueschlikon, Switzerland, March 6–7.
- Sharely. 2022. Miete, was du brauchst, Wann du es brauchst. Available online: <https://www.sharely.ch/de> (accessed on 16 May 2022).
- Shea, Matthew, and James W. Hutchin. 2018. The Importance of Environmental, Social, and Governance Risks to Surety Underwriters. *Asia-Pacific Journal of Risk and Insurance* 12: 20170016. [CrossRef]
- SIA. 2020. *Sustainability Report 2019*. Technical Report. Zurich: Swiss Insurance Association (SIA).
- Spors, Felicity. 2021. *How to Spot Greenwashing—And How to Stop It*. Geneva/Cologne: World Economic Forum. Available online: <https://www.weforum.org/agenda/2021/05/how-spot-greenwashing/> (accessed on 16 May 2022).
- SWFI. 2022. *Top 100 Largest Financial Holding Company Rankings by Total Assets*. Las Vegas: Sovereign Wealth Fund Institute (SWFI).
- Swiss Re. 2017. *Unveiling the Full Potential of Telematics—How Connected Insurance Brings Value to Insurers and Consumers: An Italian Case Study*. Technical Report. Zurich: Swiss Re.
- Swiss Re. 2021. *Sustainability Report 2020: Accelerating Sustainable Progress*. Technical Report. Zurich: Swiss Re.
- Swiss Re Institute. 2018. *World Insurance in 2017: Solid, But Mature Life Markets Weigh on Growth*. Technical Report. Zurich: Swiss Re.
- Swiss Re Institute. 2021. *The Insurance Rationale for Carbon Removal Solutions*. Technical Report. Zurich: Swiss Re.
- TCFD. 2021. *Guidance on Metrics, Targets, and Transition Plans*. Technical Report. London: Task Force on Climate-Related Financial Disclosures (TCFD).
- TCFD. 2022. *Knowledge Hub*. London: Task Force on Climate-related Financial Disclosures (TCFD). Available online: <https://www.tcfhub.org> (accessed on 16 May 2022).
- The Geneva Association. 2022. *Climate Change and Environment*. Zurich: The Geneva Association.



- Thingsy. 2022. Gemeinsam Gegen die Wegwerfgesellschaft und die Kreislaufwirtschaft Fördern! Available online: <https://thingsy.ch/movement/> (accessed on 16 May 2022).
- UNEP. 2020. *Global Status Report for Buildings and Construction: Towards a Zero-Emissions, Efficient and Resilient Buildings and Construction Sector, Executive Summary*. Technical Report. Geneva: United Nations Environment Programme (UNEP).
- UNEPFI. 2007. *CEO Briefing: Green Financial Products & Services*. Technical Report. Geneva: United Nations Environment Programme Finance Initiative (UNEPFI).
- UNEPFI. 2022a. *Net Zero Insurance Alliance*. Geneva: United Nations Environment Programme Finance Initiative (UNEPFI).
- UNEPFI. 2022b. *Principles for Responsible Insurance Signatories*. Geneva: United Nations Environment Programme Finance Initiative (UNEPFI).
- UNEPFI and PSI. 2020. *ESG Guide for Non-Life Insurance: Managing Environmental, Social and Governance Risks in Non-Life Insurance Business*. Technical Report. Geneva: United Nations Environment Programme Finance Initiative (UNEPFI) and Principles for Sustainable Insurance Initiative (PSI).
- UNGC. 2020. *Leadership for the Decade of Action*. Technical Report. Geneva and New York: United Nations Global Compact (UNGC) and Russel Reynolds Associates.
- United Nations. 2015. *The 2030 Agenda for Sustainable Development*. Technical Report. Geneva: United Nations, Department of Economic and Social Affairs, Sustainable Development. Available online: <https://sdgs.un.org/goals> (accessed on 16 May 2022).
- VCS. 2020. Neue Autoversicherung Mit Klimakompensation von VCS und Zurich—Umweltfreundlich Unterwegs Dank CO<sub>2</sub>-Kompensation. Available online: <https://www.verkehrsclub.ch/medien/detail/artikel/umweltfreundlich-unterwegs-dank-co2-kompensation> (accessed on 16 May 2022).
- Verles, Marion. 2018. How Companies Can Avoid ‘SDG-Washing’. Available online: <https://www.reutersevents.com/sustainability/how-companies-can-avoid-sdg-washing> (accessed on 16 May 2022).
- WRI and WBCSD. 2022. *Greenhouse Gas Protocol*. Washington, DC and Geneva: World Resources Institute (WRI) and World Business Council for Sustainable Development. Available online: <https://ghgprotocol.org/> (accessed on 16 May 2022).
- WWF. 2022. *Sustainable Financial Regulations and Central Bank Activities (SUSREG) Tracker*. Gland/Vaud: World Wildlife Fund (WWF). Available online: <https://www.susreg.org/assessments> (accessed on 16 May 2022).
- Zona, Rita, Kevin Roll, and Zora Law. 2014. Sustainable/Green Insurance Products. *Casualty Actuarial Society E-Forum Winter 2014*. Available online: [https://www.casact.org/sites/default/files/database/forum\\_14wforum\\_zona\\_roll\\_law.pdf](https://www.casact.org/sites/default/files/database/forum_14wforum_zona_roll_law.pdf) (accessed on 16 May 2022).
- Zurich. 2021. *Sustainability Report 2020: Building a Better Way*. Technical Report. Zurich: Zurich Insurance Group.
- Zurich. 2022. Zurich Z Volt, Unit Price for Car Charging Throughout Switzerland. Available online: <https://www.zurich.ch/en/private-customers/vehicles-and-travel/zurich-zvolt> (accessed on 16 May 2022).